Introduction to NREL Wind-Irrigation Payback Calculator

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Overview

- What is Wind Energy?
- Wind Turbine Classification (By size)
- Calculator Inputs
- Example Calculation
- Important Considerations
- Incentive Programs
- Barriers to Wind Irrigation
- Conclusions

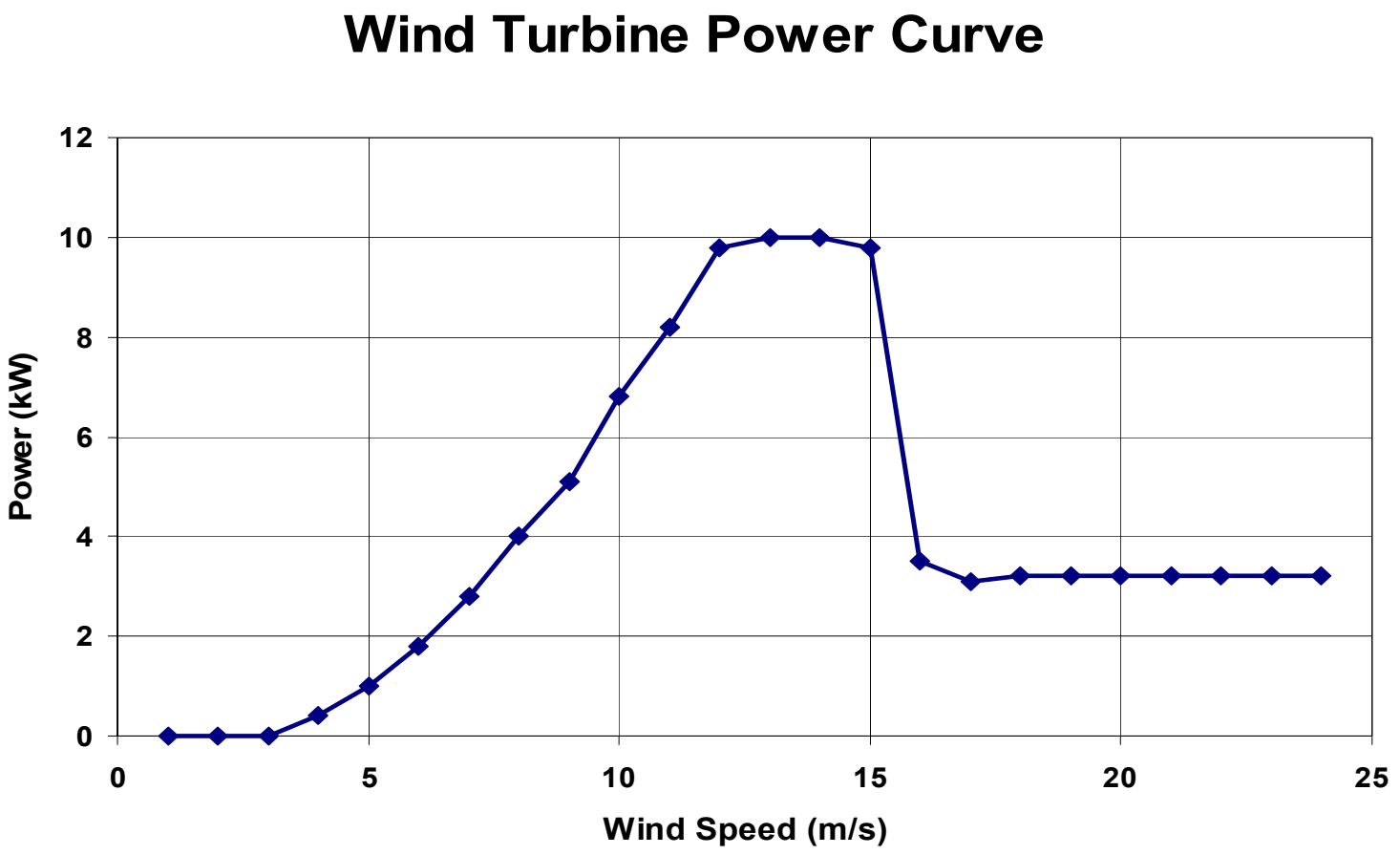
What is Wind Energy?

$$P = \frac{1}{2} \rho A V^3$$

Wind Energy Conversion Device

- Literally converts energy in wind to electrical or mechanical energy
- Power in the wind increase with the cube of the wind speed
- Wind speed generally increases with increasing height

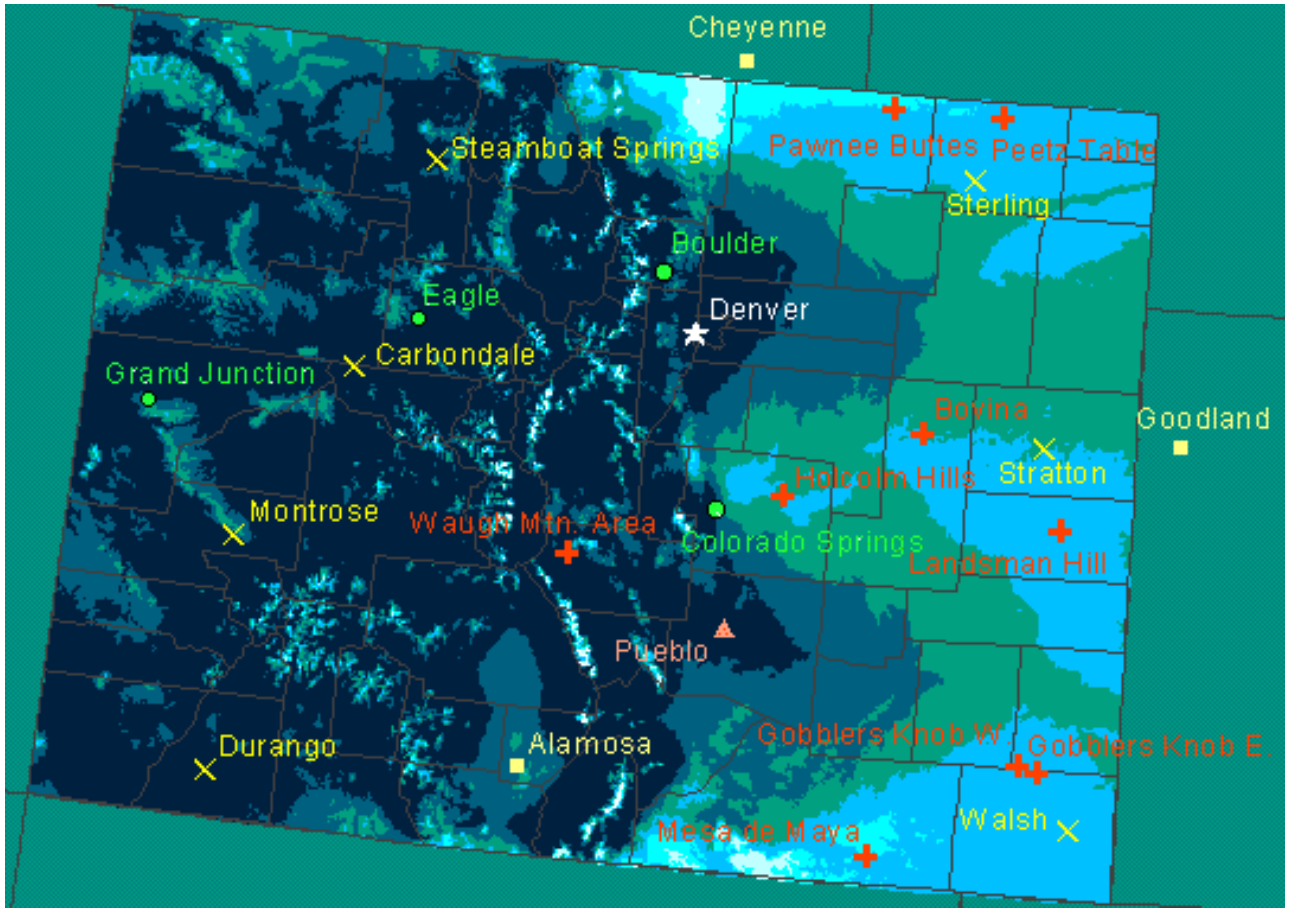
What is Wind Power?



Calculator Inputs

- **WTG Cost Data**
  Capital cost, annual O&M, property tax, insurance, lease or own?, lifetime
- **WTG Production**
  Separate calculation
- **Wind Resource (profile)**
  Allocates the annual production to each month
- **Electricity Usage**
  Monthly usage
- **Electricity Cost**
  Usage rate, demand charge, fixed monthly fee
- **Financial/Tax Information**
  Down payment, loan interest rate, marginal tax rate, discount rate

High Resolution CO Wind Map



	Anemometer height: 10 m	
	Max. wind power density (W/m^2)	Max. wind speed (m/s)
	100	4.4
	150	5.1
	200	5.6
	250	6.0
	300	6.4
	400	7.0
	1000	9.4

- WEST Associates
  - Hourly solar, wind and temperature
- WEST Associates and NSRDB
  - Hourly solar, wind and temperature
- JCEM and NSRDB
  - Hourly solar, wind and temperature
- NSRDB
  - Hourly, monthly, and TMY2 solar, wind and temperature
- Public Service Co
  - Annual average wind speed
- JCEM
  - hourly solar, wind and temperature

Source: Office of Energy Conservation
Utility Wind Resource Assessment (1995)

Calculator Outputs

- **Monthly Production**
- **WTG Energy Used and Sold**
- **Loan Repayment Schedule**
- **WTG Expenditures**
- **Savings & Revenue**
- **Tax Issues**
- **Cash Flow**

Considerations

- **Wind Resource**
- **Cost of Electricity**
- **Incentives & Buydowns**
- **Availability of Net Metering**
- **Green Tag Possibilities**

Barriers

- **High Costs**
- **Lack of Net Metering**
- **Lack of local O&M capability**

Potential Solutions

- **Green Tags**
- **Aggregation of wind turbine purchases at Co-op level**
  - **Lower cost financing ==> Pass through RUS loans**
  - **Critical mass of turbines ==> Local O&M capability**

Resources: On The Web

- AWEA Web site: http://www.awea.org
- NWTC Web site: http://www.nrel.gov/wind
- WPA Web site: http://www. Windpoweringamerica.gov
- Homepower Web Site: http://www.homepower.com
- Windustry Project: http://www.windustry.com

Conclusions

- Wind power is a potential option for irrigators possessing a good wind resource.
- Wind energy can help supply energy to rural communities while providing local economic benefits.